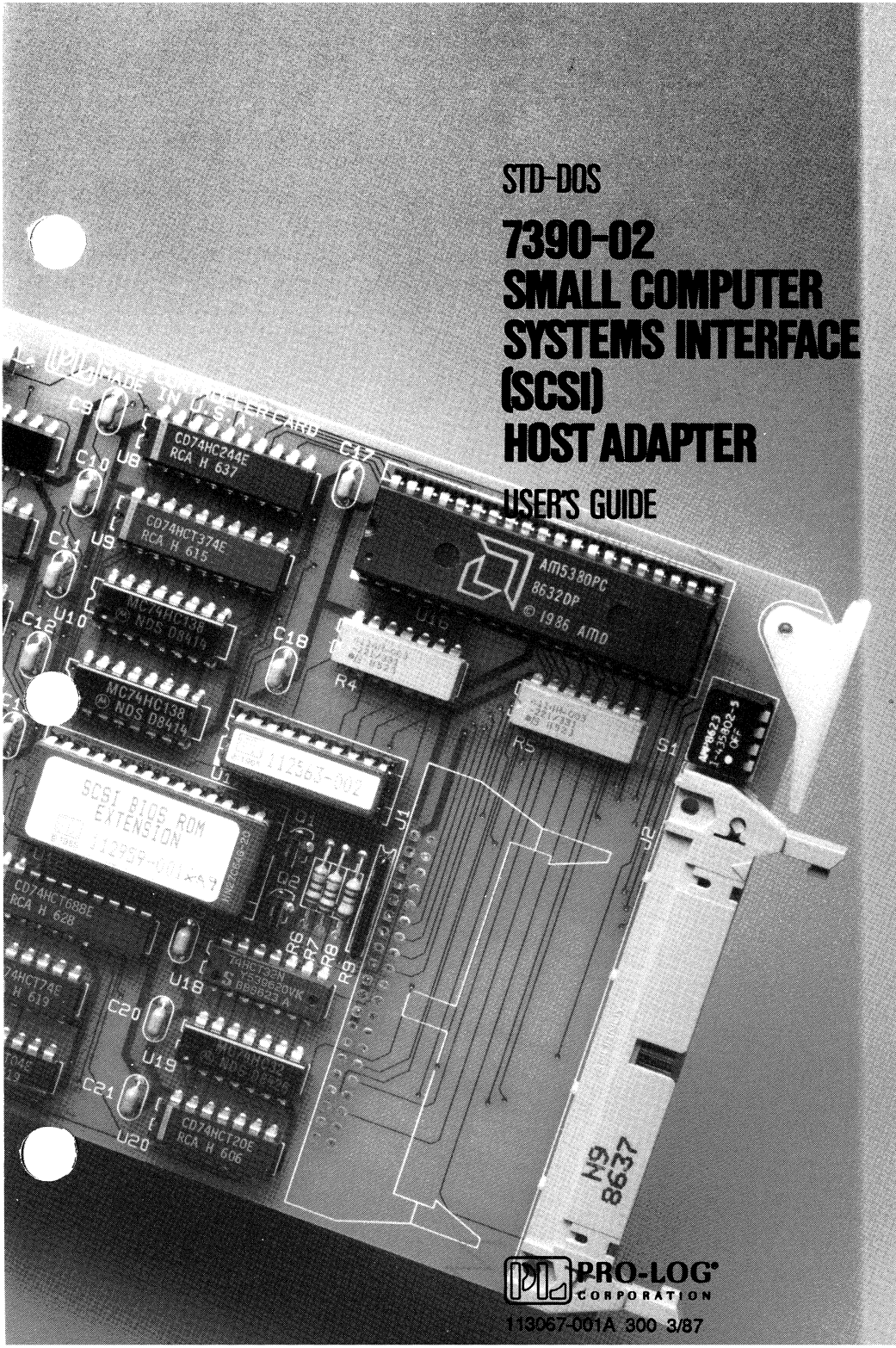
STD-DOS

7390-02 SMALL COMPUTER SYSTEMS INTERFACE (SCSI) HOST ADAPTER

USER'S GUIDE



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REFERENCES/BIBLIOGRAPHY

American National Standard for Information systems' *Small Computer Systems Interface (SCSI)* December 10, 1985 (X3T91.2 REV 17A)

NCR 5380-53C80 SCSI Interface Chip Design Manual

Advanced Micro Devices' *Am5380 SCSI Interface Controller Product Specification*

CUSTOMER SUPPORT

For technical problems, please call Pro-Log Customer Support at (800) 538-9570 from 7:00 a.m. to 5:00 p.m. (Pacific Time).

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Section 1
Introduction and Installation

1.1 INTRODUCTION

The 7390 SCSI Host Adapter Card supports a Rodime RO 652A or equivalent, 3.5-inch, 20-megabyte Winchester Disk Drive. The 7390 is used in Pro-Log's STD-DOS systems requiring mass storage. An on-card BIOS Extension PROM is provided for IBM/MS-DOS compatibility. Because of the BIOS Extension, no installation software is required. When the STD-DOS system is turned on, the card installs itself at reset or power-up.

1.2 FEATURES

- BIOS Extension for IBM/MS-DOS compatibility
- Supports Rodime RO 652A or equivalent, 3.5-inch 20-megabyte Winchester drive
- Provides all mandatory features of the draft-proposed American National Standard for Information systems' *Small Computer Systems Interface (SCSI)* December 10, 1985 (X3T91.2 REV 17A)
- Interruptable BIOS
- Meets STD-8088 Bus Specification
- Five-year parts and labor warranty
- MTBF is greater than 38 years

1.3 INSTALLATION

(1) Ensure that system power is OFF.

(2) Loosen the two thumb screws on the card rack retaining bar.

(3) Move the retaining bar to the UP position.

(4) Install the 7390 into the card rack.

Section 2

Technical Reference

NOTE: This section provides more detailed information about the 7390 SCSI Host Adapter hardware and SCSI Interface Software to the MS-DOS operating system. This information helps the user understand and more fully utilize the capabilities of the 7390 SCSI Host Adapter option. The information in this section is for reference only and is intended for hardware and software engineers who need to understand the design and operation of the 7390 SCSI Host Adapter option.

2.1 SPECIFICATIONS

2.1.1 Electrical Specification

OPERATING CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage, Vcc	+4.75	+5.00	+5.25	V
Supply Current, Icc	--	--	+530	mA

PARAMETER	RECOMMENDED LIMITS			ABSOLUTE LIMITS		
	MIN	TYP	MAX	MIN	MAX	UNITS
Ambient Temp.	0	+25	+65	-40	+75	°C
Humidity[1]	5	--	95	5	95	%RH

[1]Noncondensing

2.1.2 Mechanical Specification

The 7390 meets all general mechanical specifications of the STD Series 7000 and 70C00 Specifications, Pro-Log document number 111684.

2.1.3 Timing Specification

The 7390 meets or exceeds the timing specifications of the April 24, 1986 STD Manufacturers Group STD-8088 Bus Specification, revision 2.2, Pro-Log document number 112764.

PIN NUMBER	OUTPUT (LSTTL LOADS)		MNEMONIC	PIN NUMBER	OUTPUT (LSTTL LOADS)		MNEMONIC
	INPUT (LSTTL LOADS)					INPUT (LSTTL LOADS)	
2	IN	-	+5 VOLTS	1	-	IN	+5 VOLTS
4	IN	-	GROUND	3	-	IN	GROUND
6	-	--	DCPWRDWN*	5	-	--	VBATT
8	0.5	55	D7	7	55	0.5	D3/A19
10	0.5	55	D6	9	55	0.5	D2/A18
12	0.5	55	D5	11	55	0.5	D1/A17
14	0.5	55	D4	13	55	0.5	D0/A16
16	0.75	--	A15	15	--	0.75	A7
18	0.75	--	A14	17	--	0.75	A6
20	0.75	--	A13	19	--	0.75	A5
22	0.75	--	A12	21	--	0.75	A4
24	0.75	--	A11	23	--	0.75	A3
26	0.75	--	A1O	25	--	0.75	A2
28	0.75	--	A9	27	--	0.75	A1
30	0.75	--	A8	29	--	0.75	A0
32	0.5	--	RD*	31	--	0.5	WR*
34	0.5	--	MEMRQ*	33	--	0.5	IORQ*
36	-	--	MEMEX	35	--	-	IOEXP
38	1.35	--	MCSYNC*	37	--	-	RESERVED*
40	-	--	STATUS 0*	39	--	-	STATUS 1*
42	-	--	BUSRQ*	41	--	-	BUSAK*
44	-	55	INTRQ*	43	--	0.5	INTAK*
46	-	--	NMIRQ*	45	55	-	WAITRQ*
48	-	--	PBRESET*	47	--	0.5	SYSRESET*
50	-	--	CNTRL*	49	--	1.35	CLOCK*
52	IN	--	PCI	51	OUT	1.0	PCO
54	-	--	AUX GND	53	--	-	AUX GND
56	-	--	AUX -V	55	--	-	AUX +V

*Designates low-level active
One LSTTL load = 0.4 mA

STD Edge Connector

2.2 SOFTWARE REFERENCE

2.2.1 SCSI Interface Driver

This level of software consists of a general SCSI Command handler. Disk Drives, Tape, Drives, Printers, and other communication devices can be controlled. Almost any SCSI command can be handled with this driver. The SCSI Interface Driver software is entered through a single software interrupt, 79H.

The SCSI Interface Driver provides a method of controlling the SCSI interface with four functions. Parameters for these functions must be set up in a Request Block. The Request Block will contain Control and Status information, pointers to a Command Block, and a Data Transfer Buffer. This driver works with any Mandatory, Extended, or Optional command as defined in the SCSI specification. Most Vendor Unique Commands will probably work.

Entry Parameters

The SCSI Interface Driver is entered through a single interrupt vector (INT 79) with a far pointer in registers DX:BX to the SCSI Command Request Block and an Initiator Function code in register AH. The SCSI Command Request Block contains all parameters and pointers needed to perform a single SCSI Driver Function or Command.

2.2.2 SCSI Function Codes

These are the function codes in register AH that are used to select one of the four SCSI functions:

00 - Reset SCSI Bus
01 - Execute SCSI Command
02 - Initialize SCSI Bus
03 - Get Device Map

Reset SCSI Bus

This operation is used to reset and reinitialize the SCSI Bus and Device Map. None of the other Command Request block parameters are needed.

Execute SCSI Command

This operation selects a SCSI Target and sends a Command Block pointed to by the COMMAND POINTER parameter to perform one of the standard SCSI commands. The rest of the Command Request Block must be set up as needed for each command.

SCSI UNIT #	- BYTE	->
INITIATOR STATUS	- BYTE	<-
TARGET STATUS	- BYTE	<-
INFO TRANSFER FLAG	- BYTE	->
COMMAND POINTER	- DWORD	->
DATA POINTER	- DWORD	->
TRANSFER COUNT	- WORD	<->

-> = Entry parameter
<- = Returned parameter

Command Request Block

SCSI UNIT # -- This is the local unit number of the selected SCSI Target Device or Device Sub Unit. The DEVICE MAP uses this parameter to calculate the proper SCSI ID code and SubUnit code (LUN).

INITIATOR STATUS -- This is the Initiator Status byte. This byte indicates that the 7390 SCSI Host Adapter is functioning properly. This byte should be checked before the Target Status byte is checked. If this parameter returns an error, the Target Status byte will not be valid:

00 = No Error
FF = Error

TARGET STATUS -- The Target Status byte is returned from the Target after each SCSI Command has been executed. If the status is CHECK CONDITION, then a REQUEST SENSE command must be executed to get the SENSE KEY error code. Refer to the SCSI specification for STATUS byte and SENSE KEY definitions.

INFO TRANSFER FLAG -- The Information Transfer Flag tells the SCSI Interface Driver that there will be an Information transfer to or from the address specified by the Data Pointer.

00 = Data Transfer
FF = Information Transfer

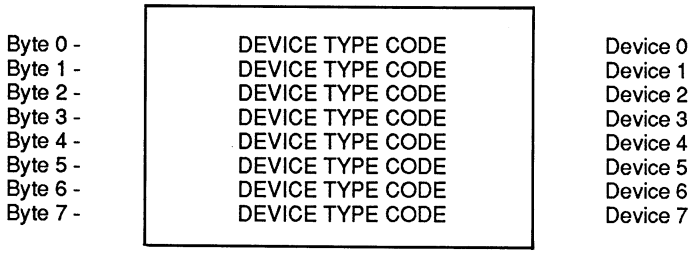
COMMAND POINTER -- This is a double word pointer to a SCSI Command Block. Refer to the SCSI specification for the format of each command.

DATA POINTER -- This is a double word pointer to the Memory Buffer where the Data or Information is transferred.

TRANSFER COUNT -- For Data transfers, this parameter is the number of sectors or blocks to be transferred to or from the disk. On completion of a Read or Write command, this parameter shall be set to the number of blocks successfully transferred. For Information Transfers, this parameter is set to the number of bytes to be transferred.

2.2.3 Initialize SCSI Bus

This operation initializes any SCSI data buffers. An attempt is made to select each possible SCSI Target. An eight-byte DEVICE MAP is created with device-type information of each SCSI Target found. The DATA POINTER parameter is set to point to the DEVICE MAP. Refer to the SCSI specification under the INQUIRY Command for Device Type Code definitions.



Device Map

Get Device Map

This operation returns a far pointer to the DEVICE MAP described in the INITIALIZE SCSI function. If the DEVICE MAP has not been initialized, an FF error code is returned in the INITIATOR STATUS location of the Command Request Block.

2.3 HARDWARE REFERENCE

2.3.1 SCSI Interface Driver

The 7390 SCSI Host Adapter is based on the NCR 5380 and its associated hardware to provide all mandatory features of the draft-proposed American National Standard for Information systems' *Small Computer System Interface (SCSI)* December 10, 1985 (X3T9.2 REV 17A).

The NCR 5380 SCSI Interface Controller product and technical description can be found in the *NCR 5380-53C80 SCSI Interface Chip Design Manual* or Advanced Micro Devices' *Am5380 SCSI Interface Controller Product Specification.*

DMA/Interrupt Controller

The DMA/INTR Controller PAL senses the SCSI Controller INTR line and generates the STD BUS INTRQ* signal. The PAL monitors the CPU-generated INTAK* sequence and PCI signals. When PCI is asserted, then during the second INTAK* the PAL gates the Interrupt Vector onto the STD BUS. If PCI is not asserted during the second INTAK*, the PAL-generated INTRQ* is removed due to another peripheral device INTRQ*. Upon completion of the second INTAK*, the PAL again asserts the INTRQ* and responds to INTAK*. After the PAL gates the Interrupt Vector onto the STD BUS, the SCSI Controller INTR request input is monitored for removal to guarantee that it will not cause a second INTRQ*.

The second function of the DMA/INTR Controller is to allow the CPU to look like a DMA controller to the SCSI peripheral controller. This is accomplished by setting a bit in a port to enable the DMA mode (DMA_EN). When this bit is set, the SCSI Controller Data Port is memory mapped into a block of memory. The CPU is set up to perform a repeat MOVSW from this block of memory. When a RD* or WR* is performed at these addresses and DRQ is asserted, the PAL Controller generates a DACK* for the duration of RD* or WR*. If the memory block is accessed and a DRQ has not occurred from the SCSI Controller, the PAL generates a WAITRQ* to the STD BUS until the DRQ is asserted.

2.3.2 Data Transfer Rate

When the 8088 CPU programs the 7390 SCSI Host Adapter into DMA mode by setting DMA_EN and performs a REP MOVSW instruction, the maximum data transfer rate is 568K bytes/second. This transfer rate is based on a V20 CPU running at 210 nanoseconds.

2.3.3 Interrupt Vector Control

An Interrupt Vector is performed via I/O port 2C9. When the DMA/INTR Controller PAL gates the Interrupt Vector onto the STD BUS during the second INTAK*, it is this port that is read.

2.3.4 PROM Jumper

The 7390 SCSI Host Adapter has only one jumper. This jumper is in series with the memory chip-select signal used to enable a PROM and the Data Bus Buffer to the STD BUS. When the jumper is not installed, a pull-up resistor is used to pull up the PROM chip-select, disabling the PROM and Data Bus Buffer for that address range. This jumper is removed for the 7390-1 version. PS-1.21/H, OS-1.21, and OD-1.21 use the 7390-1. For all other STD-DOS versions, this jumper remains installed.

PROM Address Assignment

BIOS Address Range - C8000-CBFFF

Quasi-DMA Address Range

Quasi-DMA Address Range - ED000-EDFFF

I/O PORT ADDRESS	OUTPUT FUNCTION	INPUT FUNCTION
2C0	Current SCSI Data	Current SCSI Data
2C1	Initiator Command	Initiator Command
2C2	Mode	Mode
2C3	Target Command	Target Command
2C4	Current SCSI Bus	Select Enable
2C5	Bus & Status	Start DMA Send
2C6	Input Data	Start DMA Targ. Recv.
2C7	Reset Parity/Intr	Start DMA Init. Recv.
2C8	-----	DMA Enable (DMAEN)
2C9	SCSI ID Setting	-----
2CA	-----	Interrupt Vector

Port Address Assignment

SCSI ID Switches

A four-SPST side-actuated switch mounted by the card ejector allows for setting a SCSI ID. Only the least significant three of the four switches are used. This allows for settings of 0 to 7. The value read back to the CPU is via a one-of-eight decoder; therefore, settings 0 to 7 correspond to decoded values as follows:

SETTING	SWITCH POSITION	VALUE READ (HEX)
0	000	01
1	001	02
2	010	04
3	011	08
4	100	10
5	101	20
6	110	40
7	111	80

2.3.5 SCSI Bus and Termination

The NCR 5380 SCSI Controller drives the SCSI bus directly via the 50-pin latching transition header connector. The SCSI bus signals are defined in the following:

SCSI SIGNAL	PIN	SCSI SIGNAL	PIN
-DB(0)	2	GROUND	28
-DB(1)	4	GROUND	30
-DB(2)	6	-ATN	32
-DB(3)	8	GROUND	34
-DB(4)	10	-BSY	36
-DB(5)	12	-ACK	38
-DB(6)	14	-RST	40
-DB(7)	16	-MSG	42
-DB(8)	18	-SEL	44
GROUND	20	-C/D	46
GROUND	22	-REQ	48
GROUND	24	-I/O	50
TERMPWR	26		

SCSI Bus Signals

The minus (-) preceding the signal name indicates active low as defined in the SCSI specification. All odd pins are GROUND. All signals are terminated with a 220-ohm pull-up and 330-ohm pull-down network.

2.3.6 Return for Repair/Warranty

Return for Repair Procedures

Domestic Customers:

1. Call Customer Support at (800) 538-9570 from 7 a.m. to 5 p.m. (Pacific Time).

2. Explain the problem and we may be able to solve it on the phone. If not, we will give you a Customer Return Order (CRO) number.

3. Please be sure to enclose a packing slip with CRO number, serial number of the equipment, if applicable, and reason for the return, with the name and telephone number of the person we should contact (preferably the user), if we have any further questions.

4. Pack the equipment in a solid cardboard box secured with packing material.

> **CAUTION**
>
> Loose MOS integrated circuits, or any product containing CMOS integrated circuits, must be protected from electrostatic discharge during handling and shipping. Use conductive foam pads or conductive plastic bags, and never place MOS or CMOS circuitry in contact with Styrofoam materials.

5. Ship prepaid and insured to:

   Pro-Log Corporation
   2560 Garden Road
   Monterey, California 93940

   Reference CRO #_____

International Customers

Equipment repair is handled by your Pro-Log distributor. If you need to contact Pro-Log, the factory can be reached at any time by TWX at 910-360-7082.

Limited Warranty

Limited Warranty: Seller warrants that the articles furnished hereunder are free from defects in material and workmanship and perform to applicable, published Pro-Log specifications for five years from date of shipment on STD BUS Series 7000 cards. This warranty is in lieu of any other warranty expressed or implied. In no event will Seller be liable for special or consequential damages as a result of any alleged breach of this warranty provision. The liability of Seller hereunder shall be limited to replacing or repairing, at its option, any defective units which are returned F.O.B. Seller's plant. Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. Seller shall have the right of final determination as to the existence and cause of defect. As to items repaired or replaced, the warranty shall continue in effect for the remainder of the warranty period, or for ninety (90) days following date of shipment by seller of the repaired or replaced part whichever period is longer. No liability is assumed for expendable items such as lamps and fuses. No warranty is made with respect to custom equipment or products produced to Buyer's specifications except as specifically stated in writing by Seller and contained in the contract.

2.3.7 Reference Drawings

The reference drawings in the following pages are included in this user's guide FOR REFERENCE ONLY. These drawings may differ in some respects from the card you receive from Pro-Log. If you require the specific revision documents of the schematic and assembly for the board shipped, please call Pro-Log Customer Support at (800) 538-9570 from 7:00 a.m. to 5:00 p.m. (Pacific Time).

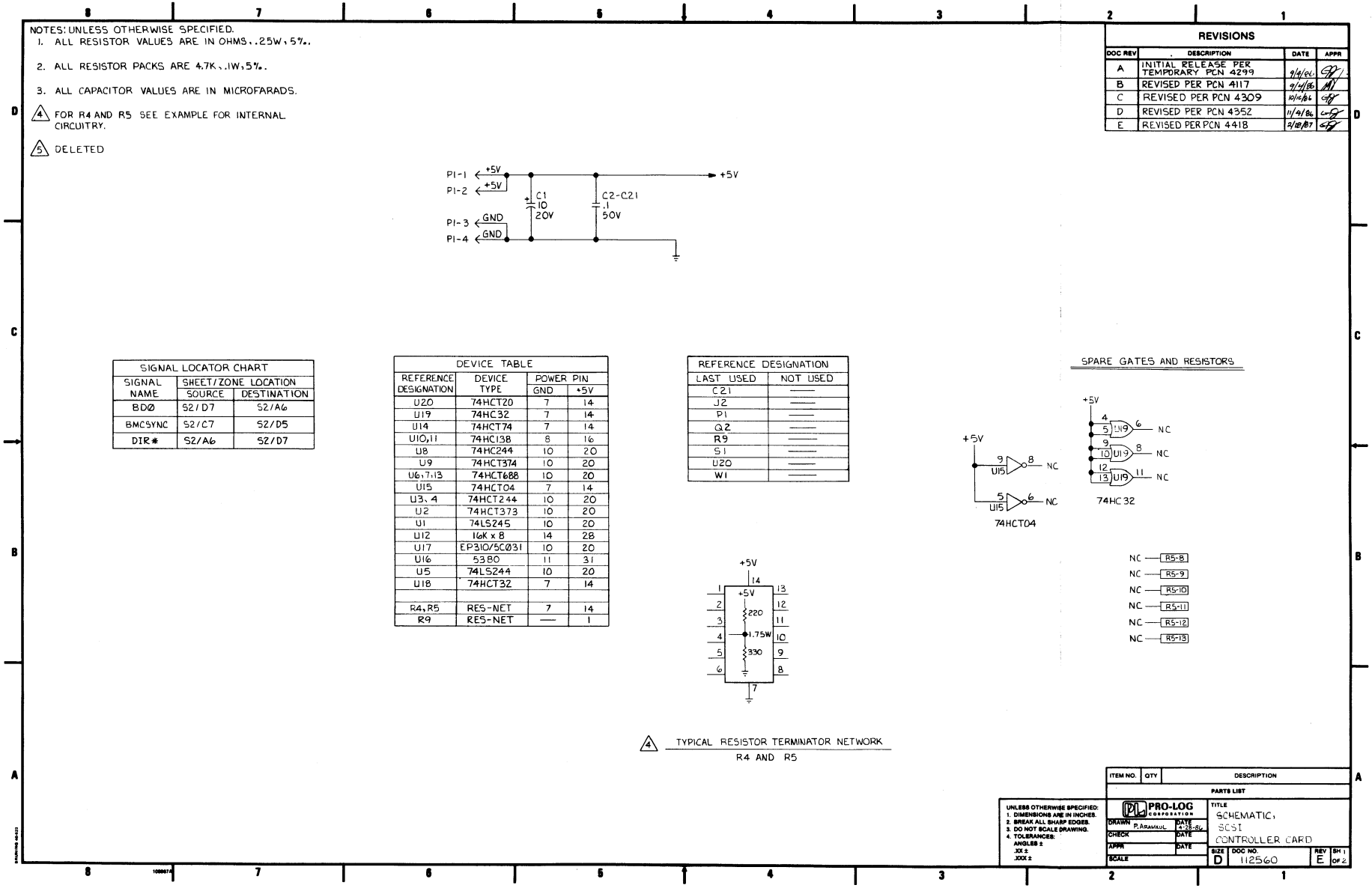

NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTOR VALUES ARE IN OHMS, .25W, 5%.
2. ALL RESISTOR PACKS ARE 4.7K, .1W, 5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4 FOR R4 AND R5 SEE EXAMPLE FOR INTERNAL CIRCUITRY.
5 DELETED
REVISIONS
DOC REV | DESCRIPTION | DATE | APPR
A | INITIAL RELEASE PER TEMPORARY PCN 4299 | 9/4/86
B | REVISED PER PCN 4117 | 9/4/86
C | REVISED PER PCN 4309 | 10/4/86
D | REVISED PER PCN 4352 | 11/4/86
E | REVISED PER PCN 4418 | 2/18/87
P1-1 +5V
P1-2 +5V
P1-3 GND
P1-4 GND
C1 10 20V
C2-C21 .1 50V
+5V
SIGNAL LOCATOR CHART
SIGNAL NAME | SHEET/ZONE LOCATION SOURCE | DESTINATION
BDØ | S2/D7 | S2/A6
BMCSYNC | S2/C7 | S2/D5
DIR* | S2/A6 | S2/D7
DEVICE TABLE
REFERENCE DESIGNATION | DEVICE TYPE | POWER PIN GND | +5V
U20 | 74HCT20 | 7 | 14
U19 | 74HC32 | 7 | 14
U14 | 74HCT74 | 7 | 14
U10,11 | 74HC138 | 8 | 16
U8 | 74HC244 | 10 | 20
U9 | 74HCT374 | 10 | 20
U6,7,13 | 74HCT688 | 10 | 20
U15 | 74HCT04 | 7 | 14
U3, 4 | 74HCT244 | 10 | 20
U2 | 74HCT373 | 10 | 20
U1 | 74LS245 | 10 | 20
U12 | 16K x 8 | 14 | 28
U17 | EP310/5C031 | 10 | 20
U16 | 5380 | 11 | 31
U5 | 74LS244 | 10 | 20
U18 | 74HCT32 | 7 | 14
R4,R5 | RES-NET | 7 | 14
R9 | RES-NET | — | 1
REFERENCE DESIGNATION
LAST USED | NOT USED
C21
J2
P1
Q2
R9
S1
U20
W1
SPARE GATES AND RESISTORS
+5V
U15 9 8 NC
U15 5 6 NC
74HCT04
+5V
U19 4 5 6 NC
U19 9 10 8 NC
U19 12 13 11 NC
74HC32
NC R5-8
NC R5-9
NC R5-10
NC R5-11
NC R5-12
NC R5-13
+5V
14
220
1.75W
330
7
4 TYPICAL RESISTOR TERMINATOR NETWORK
R4 AND R5
ITEM NO. | QTY | DESCRIPTION
PARTS LIST
UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES.
2. BREAK ALL SHARP EDGES.
3. DO NOT SCALE DRAWING.
4. TOLERANCES:
ANGLES ±
XX ±
XXX ±
PRO-LOG CORPORATION
DRAWN P. ARAMKUL DATE 4-28-86
CHECK DATE
APPR DATE
SCALE
TITLE
SCHEMATIC, SCSI CONTROLLER CARD
SIZE D | DOC NO. 112560 | REV E | SH 1 OF 2

Figure 2-1. 7390 Schematic (Page 1 of 2)
FOR REFERENCE ONLY

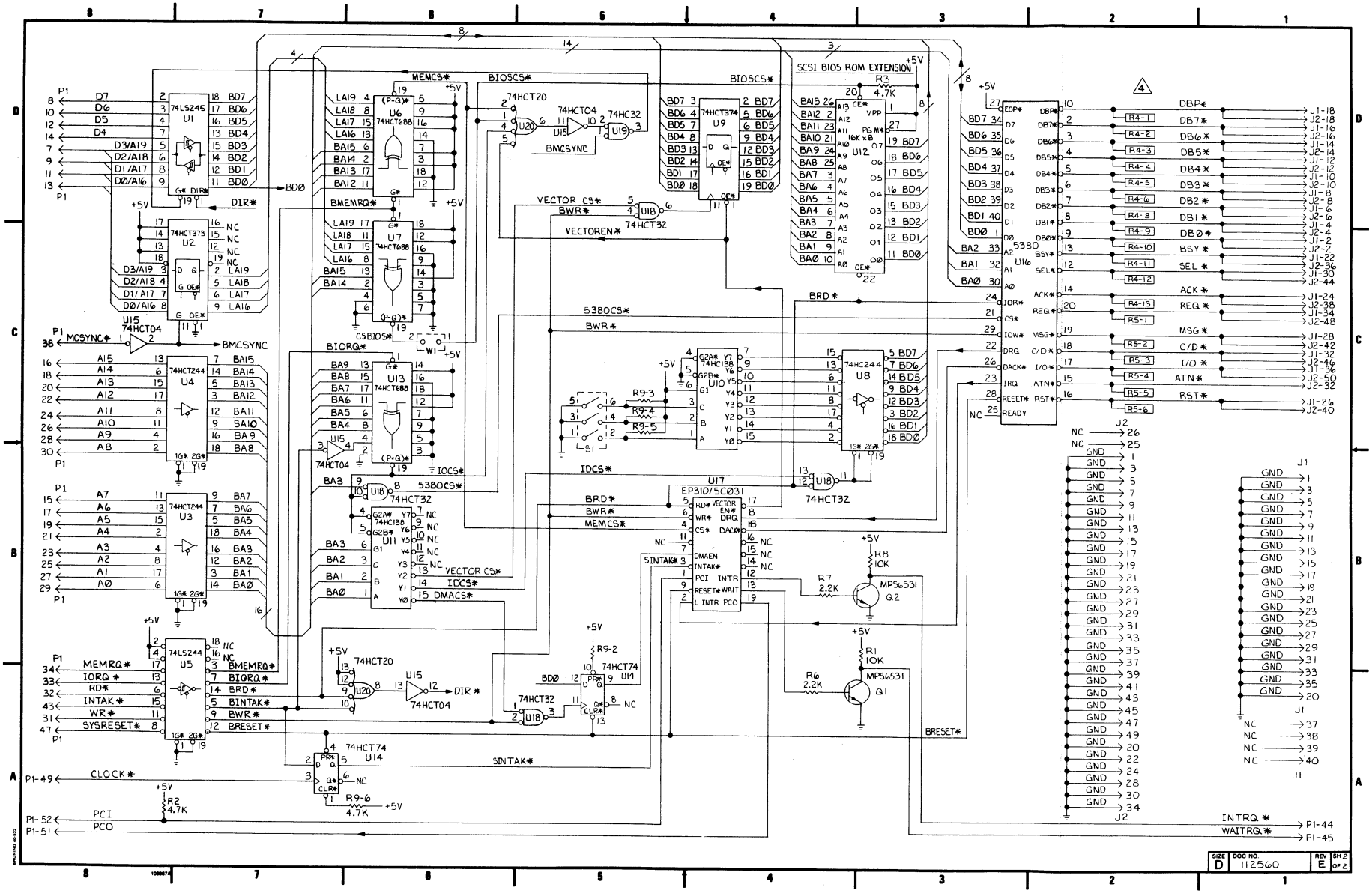


Figure 2-1. 7390 Schematic (Page 2 of 2)
FOR REFERENCE ONLY

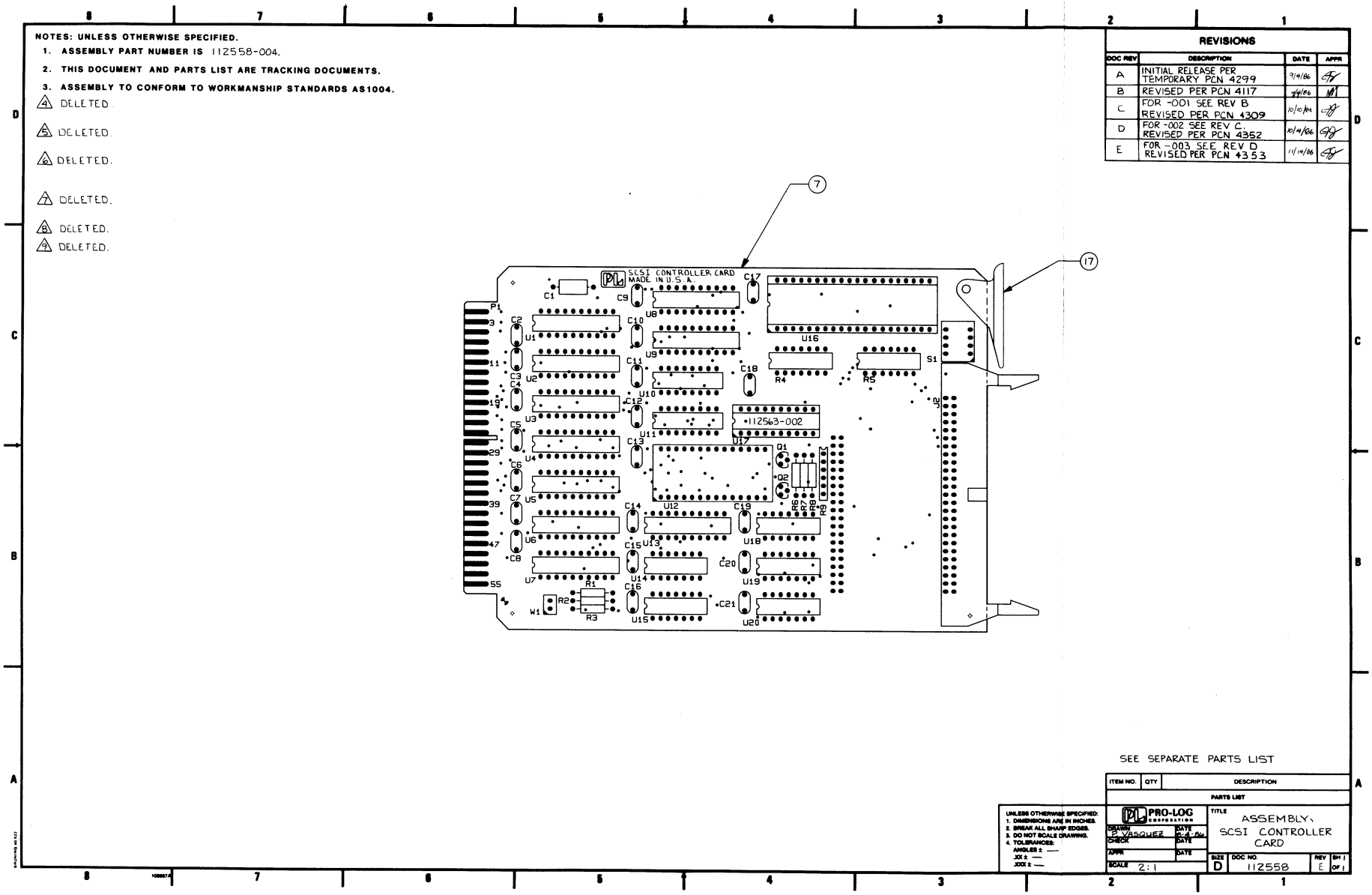

NOTES: UNLESS OTHERWISE SPECIFIED.
1. ASSEMBLY PART NUMBER IS 112558-004.
2. THIS DOCUMENT AND PARTS LIST ARE TRACKING DOCUMENTS.
3. ASSEMBLY TO CONFORM TO WORKMANSHIP STANDARDS AS1004.
4 DELETED.
5 DELETED.
6 DELETED.
7 DELETED.
8 DELETED.
9 DELETED.
REVISIONS
DOC REV | DESCRIPTION | DATE | APPR
A | INITIAL RELEASE PER TEMPORARY PCN 4299 | 9/9/86
B | REVISED PER PCN 4117 | 9/9/86
C | FOR -001 SEE REV B REVISED PER PCN 4309 | 10/10/86
D | FOR -002 SEE REV C. REVISED PER PCN 4352 | 10/9/86
E | FOR -003 SEE REV D REVISED PER PCN 4353 | 11/19/86
SCSI CONTROLLER CARD
MADE IN U.S.A.
112563-002
SEE SEPARATE PARTS LIST
ITEM NO. | QTY | DESCRIPTION
PARTS LIST
PRO-LOG CORPORATION
DRAWN P. VASQUEZ 9-4-86
CHECK
APPR
DATE
TITLE ASSEMBLY, SCSI CONTROLLER CARD
SCALE 2:1
SIZE D
DOC NO. 112558
REV E
SH 1 OF 1

Figure 2-2. 7390 Assembly Drawing
FOR REFERENCE ONLY